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ABSTRACT

A new kind of systems approach to science educational publishing is presented in this paper. This synergistic approach to the publishing of instructional materials for science education would require input from psychologists, scientists, classroom teachers, and science education researchers. The role of the science education researcher is considered of basic importance in this process, and this role is the central focus of the paper. The science education researcher is seen as serving to bridge the domains of the general learning specialists and the pure scientists, then working with the publisher to select a model program or to synthesize from several such programs, then to devise the formative studies and interpret their results, and finally to assist the publisher in constructing summative evaluation instruments. The role of the National Association for Research in Science Teaching (NARST) in providing leadership in science education and the similarities between the contemporary concerns of industry and those of education are considered. (PR)

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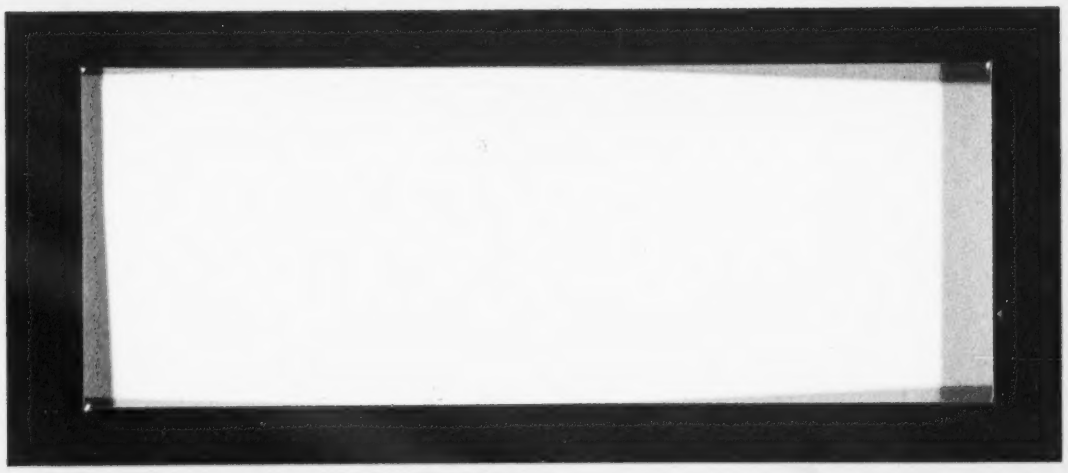

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OCCASIONAL PAPER SERIES - SCIENCE PAPER 6
RESEARCH IN SCIENCE EDUCATION AND THE DEVELOPMENT OF INSTRUCTIONAL MATERIALS

by

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and Environmental Education
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RESEARCH IN SCIENCE EDUCATION AND THE DEVELOPMENT OF INSTRUCTIONAL MATERIALS*

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To focus in more sharply on the causal relationships I perceive between science educational research and the development of science educational materials for instructional purposes, I limit my view of science educational research to the type that Professor Jacobson described in his presidential address to NARST last year as "developmental or formative studies." (1) There is little question that in recent years the federally-funded course content improvement programs--many, but not all of which can be classified in accordance with Jacobson's definition as being developmental or formative studies--have had the most profound effect on the content and form of instructional materials in science. I believe that in the case of the elementary school programs, especially, the effects of these breakthrough projects on learning materials will be pronounced for many years to come.

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*This paper is based on an invited address delivered at the First General Session of the Annual Meeting of the National Association for Research in Science Teaching (NARST), Sheraton Hotel, Silver Spring, Maryland. March 23, 1971.

That is true now, for the innovative materials directly engendered by the three most prominent studies--Science: A Process Approach, SCIS, and ESS. It will, I believe, also be true for most of the elementary school curricular materials in science to be developed and published exclusively within the educational publishing industry. For most of those materials will be based in large measure on the apparent success of the federally-financed programs. And I mean success in the best sense; student success at learning science as evidenced by feedback data during the formative stages of the development of the federally-funded model programs.

My prediction is that the new approaches to elementary school science education will have far longer-lasting effects than the ones we've seen developed for high school science education in the past twelve years. That prediction is based on my judgment that the new elementary school programs were and continue to be conceived out of psychological and philosophical principles that in themselves derive from soundly conceived and executed learning research. Admittedly, interpretive findings of such research have led to a number of expert viewpoints--sometimes widely divergent. It is comforting, if not critical in this emergent era of educational accountability, for educational publishers to ally themselves with a point of view that has withstood the rigors of formative evaluation whether it is the point of view of a Gagné or a Piaget, of a Hawkins or a Glaser, of an Ausubel or, even, for that matter, of a Skinner. Heretofore, the development of science educational materials by the industry has been based on the highly idiosyncratic views of science educators and editorial staffs

derived from cumulative classroom experiences of the most empirical sort. Hereafter, that approach will not suffice.

It is salutary to point out, I think, that the idiosyncratic approach to publishing is not the exclusive property of the traditional educational publisher. The objective critic, conversant with their histories, would agree with me that the CBA and CHEM Study programs are highly idiosyncratic, as are the PSSC and Project Physics courses. So, too, are the ESCP and ECCP courses, and though perhaps to a lesser degree, so, too, are the three BSCS programs. Each reflects a predominant viewpoint of science instruction based almost as much on empiricism and intuition as were earlier high school programs.

What happened at the high school level with respect to curriculum reform, I believe, is that one set of traditional materials based on arguable premises vis à vis instructional content and pedagogy was challenged and partially replaced by another set of materials based on an equally arguable set of premises. By the 1960's, after decades of human inertia, the high school science curriculum and curricular materials in support of it, were based by default on the simplistic notion that the accretion by young people of technological and taxonomic facts, often bordering on the extinct, was evidence of science learning by those youth. In the early sixties, as professional scientists began to pick up the contributory options they had long defaulted on insofar as the development of curriculum materials are concerned, the prevailing idea was that the high school student could learn science only if he acted like a scientist. We all know what happened, and perhaps some of us still concur with Weinberg's polar views that:

> "The new curricula try hard to be interesting, and in this I think they succeed; also, they demand more effort and present more challenge than the old. But, insofar as the new curricula have been captured by university scientists and mathematicians of narrowly puristic outlook, insofar as the curricula reflect deplorable fragmentation and abstraction, especially of mathematics, insofar as the curricula deny science as codification in favor of science as search, I consider them to be dangerous.
>
> The professional purists, representing the spirit of the fragmented, research-oriented university, got hold of the curriculum reform and, by their diligence and aggressiveness, created puristic monsters. But education at the elementary level of a field is too important to be left entirely to the professionals in that field, especially if the professionals are themselves too narrowly specialized in outlook." (2)

What, then, about education in science at its most elementary level--the elementary school? Who are the professionals to be involved? I have no doubt that the leaders among those professionals will be from among the ranks of those in science education research. For the science education researcher bridges the extreme specializations that must be brought to bear to help children to learn science. He stands in the enviable position between the general learning specialist and the subject matter specialist; and he is linked to each, arm in arm. If either link is a weak one, future programs in which he is involved will be weak. Hereafter, science programs at any level will derive their inherent strengths from the inputs of psychologists and scientists that have been tempered by the research based judgments and classroom experiences of the science education researcher. This synergetic approach to science educational publishing, involving at its developmental core the contributions of psychologists, scientists, and science education researchers,

is the one, I believe, that can best result in programs consistent with the practical realities of American schools, rather than in programs of such complexity and cost as to be elitist or unmanageable, or both.

What I have been attempting to project then is a new kind of systems-approach to science educational publishing, whether it be in the context of federally funded projects or wholly within the domain of the educational publishing industry. The classic situation of the past where one or two authors--in most, but not all cases accurately called science education researchers--teamed with editorial staffs--in most, but not all cases, consisting of former science teachers and supervisors--to produce science education materials will disappear. The new teams will consist of scientists to help establish disciplinary and interdisciplinary priorities. There will be the learning specialists to help structure those priorities in cognitive and affective hierarchies consonant with children's abilities. There will be the classroom teachers to help effect materials that will be sensible to manage. But of most importance, there will be the science education researchers and the editorial staffs to serve as the mortar binding together the scientific, psychological, and classroom management inputs into pedagogies and programs that will in the ultimate be meaningful to children. But pedagogies and programs are at the heart of curriculum. What I maintain, then, is that leadership in directing the extraordinarily important task of ordering scientific content and process in the formulation of the science curriculum will belong to the science education researcher. It has not always been thus in the past. But I firmly believe that it must be so in the future.

In a recent and brilliant paper (3), Weinberg has brought into sharp focus the fact that urgent questions of scientific priorities, engendered by budgetary pressures in these troubled times, have brought about an enhanced concern for values in science, for what the philosopher calls an axiology of science. And is it not so that value judgments of the most profound sort are at the core of curriculum building? But is it not also reasonable to expect that the science education researcher, who makes those value judgments whenever he can on the basis of research findings as they relate to children, should contribute most to curriculum building, and thereby infuse the science curriculum with axiological elements of long-lasting import?

I have projected a new kind of systems approach to science education publishing, be it in the public or the private sector. Will there always be a public sector to science education publishing? Should there be?

I believe it is reasonable to expect that unless the economics of school publishing in science changes in a dramatic way in the coming years, breakthrough approaches to science education, and the development of model programs requiring several years of development and formative evaluation, must continue to be subsidized through public and foundation funding.* Surely there is at least as much logic in expending public monies to develop sound learning systems models as there is to develop supersonic transport or space vehicles.

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*The views are those of the writer, alone. They should not be construed as reflective of Scott, Foresman and Company corporate policy. Nor should they be considered as a general expression of the educational publishing industry's point of view.

Imagine, if you will, the total public expenditure for every science and mathematics course content improvement project initiated in the United States in the past twelve years cost less than 1 per cent of the $20 billion we spent to send Apollo XI to the moon. As counterpoint to that consideration, in 1969 the net sales of all textbooks for use in all subjects taught in the elementary, junior, and senior high schools in the country was less than 1.5 per cent of all monies spent for public and private school education that year. This is not to deny the educational publisher's responsibility to engage in prepublication, formative evaluation of developing programs. But the extent, and thereby the cost for such evaluation must obviously be commensurate with the expected return on the publisher's total investment. Given an elementary school science and health market estimated at $23 million in 1969--a modest, to say the least, 8.0 per cent of the total elementary school textbook market--and given a high school science market of $27 million, or 16.0 per cent of the total high school textbook market that year--and add the sobering reality that there are probably fifty publishers of some note which shared that combined market of $50 million, you can see that the economics of prepublication, formative evaluation in science education publishing can be formidable to contemplate.

It is of further interest to note that in 1969, the industry-wide average editorial expense--which is the cost of maintaining editorial staffs, of retaining the services of expert consultants, of assuming author and consultant expenses, of research and development on future products, and of prepublication, formative evaluation of products under development--came to 5.9 per cent of total industry sales. The industry wide average

net profit that year was 6.0 percent of total sales, and, in the event some authors may feel abused at times, the industry-wide average author's royalty for elementary, junior, and senior high school textbooks combined was 6.8 percent of sales. (4)

There is, I suspect, a premise that immediately comes to mind. If the publisher would invest more prepublication dollars in the formative evaluation of his programs, he would likely capture a larger percent of the total market available to him. Well, if this were the best of all possible worlds, that might indeed come to pass, but it isn't. Let me describe some of the realities the educational publisher meets with.

The most dramatic notion to contend with is the state adoption phenomenon. In twenty-four of these United States, virtually all in the southeast, southwest, and far west, textbook content criteria are established on a state-wide basis. Publishers compete before textbook committees to have their programs listed as conforming with those criteria, and of being of sufficient merit to be worthy of further consideration for purchase by local school districts using state textbook funds. Unless a publisher's program is listed in such a state, he is effectively shut out of the basal textbook market in that state for a minimum of three, and for sometimes as long as five years. There are many major urban centers in non-adoption states which follow similar textbook adoption proceedings. Thus, while not to be listed for purchase in Nevada might not be economically catastrophic to a given publisher, to miss a textbook listing in New York City, or Chicago, or Detroit, could indeed be.

I have specifically emphasized the textbook as the primary learning artifact to be considered, because a casebound textbook is indeed a primary criterion in every state adoption situation (as it almost always is in the major-city adoptions). Thus, unless there is a dramatic change in state laws relating to textbook adoptions, and there's no evidence that enlightenment is sweeping through our state legislatures in this regard, the materials that comprise Science: A Process Approach, the SCIS and the ESS modular units, all exemplars of materials published after extensive formative evaluation periods, will not be allowed the opportunity to compete with standard elementary school science textbook programs that have had little or no formative evaluation. Thus, formative evaluation support notwithstanding, it will be the rare educational publisher indeed, among those considering themselves preparing materials for a national market, who will venture to publish a science program in which a casebound textbook is absent.

If adoption proceedings in many states and most major urban centers are hidebound anachronisms with which the publisher must contend, there is an emerging reality that is growing in scope in our school systems and with which the publisher must also content. Let us assume we have a published elementary school science program with valid evidence of the formative evaluation that brought it to its published condition. The era of accountability is upon us, and there are a growing number of school districts which now insist that competing published programs be piloted in several classes for a year before one of the programs is adopted throughout the system. In other words, the trend to a kind of visceral summative analysis is now upon us. In many cases,

the cost of piloting is borne by the publishers; in others the district shares in the cost. In both these instances, an entire school system may be subsidized in whole or in part for an entire school year by a group of publishers insofar as the instructional materials for a given curriculum area is concerned. And in each of these instances a new element in the cost of doing business must be assumed by the publishers. There are, of course, school systems that bear the entire cost of pilot programs. But even in these cases, the message is clear. It goes something like this: "We're pleased to know that your program was evaluated during its development, and changed in accordance with feedback from the classroom. Even so, we'd like to know if your program will work in our schools with our teachers and with our students. Before we invest for five years, let us try it out for one."

How does one react to that simplistically logical argument? Possibly the most generally accepted view among publishers of educational materials of accountability as it relates to their products was expressed in a recent issue of Publishers' Weekly:

> "What can a publisher, bidding his books for an adoption, say that his books will guarantee in the way of performance? He may know that the books will be the best efforts of the best talent available but in any classroom the books may succeed and fail at the same time. To think of education as something to be guaranteed is to take a very narrow view of human nature." (5)

There are other factors--virtually all economic--that seriously limit the extent to which an educational publisher may build in a formative evaluation phase for a major developing program. Despite those limiting factors there must be some prepublication evaluation,

and I believe the science education researcher must be enlisted to plan, implement, and interpret such formative studies. Further, since I am firmly convinced that most future elementary, junior, and senior high school science programs will be derived from model programs developed through federal and foundation subsidies, the educational publishing industry must enlist the services of the science education researcher to help structure the derivative programs. For it is that researcher who probably can best analyze and dispassionately interpret the formative data of the model programs, and who can best suggest appropriate syntheses of model elements into a commercially-produced program. Such a commercially-produced program has the best chance of being educationally valid, within the constraints of analytic reasoning brought to bear by the science education researcher, and of being concomitantly economically viable, within the marketing constraints established by the publisher. On that initial input from the science education research community, and with its continued assistance, the publisher through his editorial staff would then bring together the other specialists--the psychologists, the scientists, the communications experts, the graphic designers, the media designers--whose individual inputs would be synergetically molded into valid learning materials.

To summarize the roles of research in science education in the development of future instructional materials, as I see them, they are four variations on a theme. The theme is, again in Jacobson's words, "developmental research." First, in the context of breakthrough or model programs, the science education researcher must take the leading

role, bridging as he does, the domains of the general learning specialists and the pure scientists. Then, in the context of commercial publishing, the science education researcher must be enlisted to work in tandem with editorial staffs, to select the model program to be the basis for, or to synthesize from several such programs the vehicle to be developed consonant with the publisher's business objectives. Then, in that same context, the science education researcher must devise the formative studies and interpret their results prior to the publication of the commercial program. Finally, since any published science education program essentially continues to develop through revision stages, the science education researcher should be enlisted by the publisher to construct summative evaluation instruments, the use of which would vouchsafe more meaningful revisionary development of commercially produced science programs than we have had before.

I would like to end this paper with an expression of my views concerning the role of professional organizations such as NARST in influencing the nature of instructional materials for science teaching, a consideration closely related to the ones already made. Again, I cite Professor Jacobson's remarks a year ago. He said then:

> "We have learned again during this period of science curriculum development that the teacher is of central importance in a learning situation, probably more important than the materials, facilities, buildings or type of school organization. It may be that the teacher and how he teaches is more important in science instruction than in many other areas of the curriculum because so much of what we want to convey to students takes the form of general approaches to the universe, processes in dealing with problems, and attitudes toward fact and fancy. It may be that the most effective way to convey these elements of science instruction is through a teacher who can provide a model for his students." (6)

It strikes me that the members of NARST, especially, are particularly suited to effect the changes implied by Jacobson's observations. Certainly, from their respected positions as research scholars they are best suited to pursue Jacobson's appropriately derived solution--"developmental studies in teacher education which will help future teachers to learn how to provide such models." But as, or even more importantly, they are more than scholars doing behavioral research within the context of science instruction and learning. They are pragmatists involved in the day-to-day molding of tomorrow's science teachers. As a case in point, I doubt that there isn't one of them who hasn't taught a science methods course during his academic career, and most of them probably still do. And it is probably a certainty that they presently provide the best teaching models available for their pre-service students. But those in NARST are as the tip of the iceberg, a small fraction of the thousands involved in the pre-service education of science teachers. Until more in NARST influence more of them, there is little prospect that science educational materials, regardless of how innovative and valid they may be, will be implemented with any more successful outcomes in our schools than we presently discern.

The question, of course, is how can the members of NARST be of more influence within the entire pre-service labyrinth that spreads across our country? In the first place, new ways must be found to select those who will become our teachers. If it is true as Haberman recently wrote that:

> "Although the number of students in teacher education programs is increasing, **30 per cent** of those who are graduated and certified never begin actual teaching and an additional **60 per cent** quit in less than five years, most of these in the first year..."

and if it is further the case as Haberman contends it to be that:

> "No selection criteria used thus far have been reliable predictors of future success. (Those) most widely used...are usually irrelevancies, such as grades, citizenship, and chest x-rays, which offer no theoretical justification for correlation with future performance..." (7)

then the time has long since come for critical self-analysis on a national scope among our teacher preparation institutions. And I believe that leadership for such self-analysis can only come from an organization such as NARST, for whose members the dispassionate objectivity of research is presumably a paramount motivational factor, and not from among the plethora of professional educator groups, which seem more often than not to be motivated by insular, self-serving ends.

After selection, there is program. What should teacher preparation programs in science and in science education be? Who shall structure them? Who shall teach them? Again, I believe that NARST can and must assume a leadership role. I believe that, at the least, there must come to pass the establishment of national minimal standards for the pre-service education of science teachers. And that such standards must be considerably higher than the least common denominator of state standards that presently exist. I believe, as did Newton and Watson in the concluding sentence of their dispiriting 1968 Research On Science Education Survey, that "the times call for a strong professional organization to assume a leadership role in the focusing of energy and efforts in science education." (8) In NARST are men and women whose intellectual pursuits cover all the model programs extant. Thus a NARST-developed set of teacher preparation guidelines would benefit all such programs at the expense of none.

NARST-prepared guidelines would, I believe, find acceptance in the general academic community where you are respected for your research efforts, and more importantly, in the vast teacher-preparation community, where you have respect as practitioners who have toiled in the vineyards of teaching. The preparation of such guidelines is not enough, of course. The implementation of them, or any other set on which a consensus agreement might obtain, such as the AAAS-NASDTEC guidelines, must be made to happen. And those in NARST, who practice as well as preach, might make it happen.

But even if all this were to come about in the teacher preparation institutions, and soon, it would not be enough. Change must come to schools as they are, not only so that future ones will be as they should. The obdurate shell of the monolithic school system must be pierced from without before it bursts from within. Consider the plaintive observations of Dr. Harvey Scribner, Chancellor of the New York City School System:

> In the schools, we tend to emphasize schooling instead of learning, buildings instead of space the passing of tests instead of the acquisition of an education. We squabble in the name of reform, instead of cooperating on common goals for the sake of reform. ...We ought to ask questions about the needs of kids and not the needs of schools. The answers will be the starting point of reform. (9)

Who would be as uniquely qualified to pose those questions, and to bring the diverse public and private parties to those questions together to seek their solutions, than those in NARST? After all, through their immersion in the daily affairs of the schools, directly or through the pre-service students they send into them, they have profound understanding of the way it is. But from their scholarly efforts, they know the way it's supposed

to be. I believe then that NARST must pick up the cudgel and crack open that obdurate shell of public schooling that stifles the children within it. Again, those in NARST stand in the unique position--scholars who are also practitioners.

In his book, Excellence. Can We Be Equal and Excellent, Too?, John Gardner has dynamically restated the dominant theme that has uniquely characterized American education:

> We would educate some youngsters by sending them on to college. We would educate others in other ways. We would develop an enormous variety of patterns to fit the enormous variety of individuals. And no pattern would be regarded as socially superior or involving greater human dignity than any other pattern. (10)

This statement underscores the fact that education is perhaps the major institution in our society committed to the pluralism that is the essence of the American way of life. Religion, sports, industry, and commercial enterprise--these and all other structures within our society have exhibited concrete realization of this principle in varying degrees throughout our history, but it is to the schools that we must turn for primary commitment.

The recognition and satisfaction of a wide variety of human needs is as essential to business and industry as it is to education. To a large extent the basic concerns of education and industry are remarkably similar today. The economics of both are clearly related to problems of supply and demand, of production and distribution, and of quantity and quality. The efficient and effective utilization of human and technical resources is as essential to education as it is to industry. Whether universal prosperity or universal free education is the goal, our constant concern remains the equitable distribution of resources for the optimum number of our citizens.

Rivaling our profound belief in the strengths of a pluralistic society is our equally profound dedication to national collective unity. The fundamental task before us, then, as it always has been, is to weave these divergent principles into the fabric of American life. As Gardner has remarked in commenting on the present drift of American society, "We must restore both a vigorous sense of individuality and a sense of shared purpose. Either without the other leads to consequences abhorrent to us." (11) The necessity for perpetuating this duality in every area and at every level of national endeavor is mandatory for the maintenance and growth of the idea of democratic state cherished by Americans.

The school, being the principal societal instrument for assimilation and socialization in America, has the major responsibility to uphold and disseminate these principles. These roles must be reflected both in school philosophy and methodology. However, in recent years the capacity of the school to function effectively in this manner has been increasingly limited by persisting patterns of orthodox organization and methodology not consonant with contemporary needs. There has been a definite and quite understandable lag in revising or replacing traditional means of communication in the educational process. The system of education has resisted most every attempt to allocate aspects of instructional and learning processes to other than direct human interaction. Such resistance constitutes the basic problem for accepting innovation in the classroom.

Industry, as it has evolved since the industrial revolution, can provide a valuable and relevant model for removing misunderstanding or reducing threat insofar as innovation in education is concerned. In

pre-industrial times, man, with a few mechanical extensions of his anatomy, was the sole and absolute effector of industrial productivity. The advent of the machine age created an infinite field of possibilities for realizing economic growth wherein man increasingly became the master rather than the slave. Notwithstanding its tragic abuses, the intelligent and humane use of technology has created a vast range of alternatives to human exploitation resulting in higher standards of living through increased productivity, and a more noble and enlightened existence for man.

And the revolution hasn't been confined solely to the industrial complex. The professions, although more wary of accepting rapid change, have experienced tremendous upheaval in methodology and practice, particularly in the past three decades. Few of us would deny the startling advances that medicine and engineering have made within our lifetime. Some of us might not be alive today nor enjoying the experience of living as fully as we do were it not for innovation in those professions. It seems reasonable, therefore, that teachers and administrators, the human mortar of our schools, should be assured by the dramatic and positive outcomes that have resulted from the embracement of change as an inherent property of industrial and professional growth.

In satisfying the diverse needs of a burgeoning and increasingly sophisticated populace, industry has had spectacular success. In catering to the specific and varied demands of consumers it has, at the same time, made possession of a uniformly higher standard of living more universally feasible. Skills and pride in craft, although somewhat eclipsed by

techniques at the outset of technological innovation, have returned dimensionally superior in both quantity and quality.

Providing for a multiplicity of human needs, while at the same time making goods and services more widely available to all, reflects the continuing dedication of industrial and professional groups to the American paradox of sustaining the coexistence of diversity and unity. And, contrary to popular conceptions, both producer and consumer have emerged as beneficiaries of the technological revolution.

Supply and demand never have been equalized and, according to some economic theories, never will be. But there is little argument that a growing proportion of our population is benefitting from productivity as a direct result of mechanization and automation. Techniques of distribution which guarantee a more equitable sharing of society's resources are just beginning to benefit from application of technological methods. The war on poverty is fundamentally concerned with discovering means of disseminating the growing abundance of our productivity in a more just and fair fashion. Overproduction of goods threatens to choke further expansion of our society unless theories and methodologies of distribution equally as inventive and realistic as their production counterparts can be found. Some of the best minds today working with vast quantities of supporting private and public funds are being marshalled to solve this problem.

Industry has persistently been plagued with how both quantity and quality can be maintained in the face of growing demand and productivity. Popularization in our culture has frequently led to vulgarization. The constant and growing emphasis on change to assure a high level of quality

at ever increasing rates of output provides the only bastion to the downgrading of society through dissemination of inferior goods and services. The uplifting of man is closely related to creating an environment rich in functional and aesthetically valid materials.

How do the contemporary concerns of industry relate to education and particularly to instruction? The parallels may not be obvious or exact but they are, I believe, most assuredly there. Education has the very same problems of mass culture to contend with as does industry. The ever-growing diversity of our student population and our commitment to its universal free education make Horace Mann's visionary postulates seem simple and naive in the light of today's complex and sophisticated demands.

And this is just a fraction of the problem. The growing numbers of students is accompanied by related increased diversities of aptitude, ability, and interest which in turn demand richer varieties of instructional procedures in addition to more highly specialized educational facilities. Furthermore, the proliferation of knowledge and the concomitant growth of vocational and professional specialization make futile any attempt to adapt orthodox instructional methods for much of the present and all future educational demands. As Toffler has so cogently pointed out in Future Shock:

> "What passes for education today, even in our "best" schools and colleges, is a hopeless anachronism. Parents look to education to fit their children for life in the future. Teachers warn that lack of an education will cripple a child's chances in the world of tomorrow. Government ministries, churches, the mass media--all exhort young people to stay in school, insisting that now, as never before, one's future is almost wholly dependent upon education. Yet for all this rhetoric about the future, our schools face backward toward a dying system, rather than forward to the emerging new society...

> To help avert future shock, we must create a super-industrial education system. And to do this, we must search for our objectives and methods in the future, rather than the past." (12)

The efficiency of our entire educational system is in serious jeopardy unless a new and richer dialogue can be established in the instructional situation through innovation, much of it, perforce, to be technological. Just as our industrial potential was and continues to be realized through varietal changes, so, too, our educational potential must be released and directed through planned application of a variety of pedagogies if our hopes for excellence in our future are to become reality.

Our teachers now and in the future--must be made aware that the socializing role of education should never predominate to the extent in our schools that it threatens to engulf or completely eradicate the individualizing aspect of education. Desperation programs to contend with the enormity of our educational task through mass instruction tend to accept uniformity and subvert diversity. This not only endangers the delicate balance of forces which causes America as a nation to cohere but also violates the right of every citizen to grow freely as his unique personality dictates. In place of desperation programs there must be innovative programs based on sound developmental research studies. The evanescent palliatives born of desperation must be replaced by programs that will effect real and meaningful change.

The institution of innovative change is often considered as basically threatening to the role and status of the teacher. Quite to the contrary! As in the case of industry and other professional areas, where

intelligent and creative use of innovation technology has led to unparalleled growth, so the intelligent and creative use of innovative pedagogy has been shown to enhance both teaching and learning in the hands of imaginative and courageous teachers.

The knowledge explosion, with its subsequent, continuing rapid accrual of information, is the counterpart of the industrial over-productivity mentioned previously. As in that case, the problem of distribution has become the acute consideration of the day. Obsolete procedures for disseminating knowledge impose a barrier to the free growth of our society. As the poor distribution of goods creates economic deprivation, so even our best traditional schools will increasingly spawn cultural deprivation unless revision of instructional techniques is persistently pursued through research-based innovation.

Excellence in education demands the utmost in quality as well as in quantity. Its effective realization can only come about through the continued joint efforts of scholars, educators, and psychologists--men and women as those in NARST.

If the work of such specialists in creating academically sound and pedagogically manageable instructional programs, consonant with modern knowledge of cognition, is disseminated through a diversity of instructional techniques, designed to cater to and sustain the diversity of learner needs and aspirations, then the goals of excellence, about which we talk so earnestly, can be met.

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